

II. MONOGRAPH OF THE GENUS ELODEA, SUMMARY.

CONTINUED FROM P. 35

HAROLD ST. JOHN

Resurrection of the Family Elodeaceae.

Key to genera.

Egeria.

Elodea.

Key to subgenera, sections and species.

List of *Elodea* species.

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ELODEACEAE Dumortier

Analyse des familles des plantes (1829) 54.

Submerged perennial aquatics, growing from rootstocks or stolons. Leaves opposite or mostly whorled. Flowers perfect or dioecious, enclosed at first by a spathe; hypanthium in perfect and in pistillate flowers well developed, an elongating thread-like tube; perianth regular; sepals 3; petals 3 (or 0); stamens 3 in perfect flowers, or as 3 staminodia in pistillate flowers, or reduced to 1-2; style equaling or exceeding the hypanthium; stigmas 3, and 2-lobed (or entire); ovary superior, 1-celled, with 3 parietal placentae; ovules orthotropous or anatropous, several to numerous; capsule ellipsoid, indehiscent or tardily dehiscent; seeds ellipsoid. Staminate flowers of most dioecious species exerted from the spathe by the elongating, slender tubular base of the hypanthium; stamens 9, mostly in 2 series, the 6 outer ones with short filaments, radiating in a lower ring, the 3 inner ones raised on their fused filaments. In *E. Nuttallii* the staminate flowers sessile, becoming detached and floating to the surface of the water.

Lectotype: *Elodea* Rich. in Michx., Fl. Bor.-Am. 1 (1803) 20.

Also in this family is the genus *Egeria* Planchon.

Dumortier based his new family Elodeaceae on the genera *Elodea*, *Anacharis*, and *Hydrilla*. *Anacharis* is a taxonomic synonym of *Elodea*. *Hydrilla* is superficially very similar, but the pistillate flowers are epigynous, so it is here restored to the Hydrocharitaceae. That leaves of the original ones in the Elodeaceae only the genus *Elodea*, and it is here designated as the lectotype of the family.

Though very different in vegetative characters the genus *Vallisneria* has flowers similar to those of *Elodea*. However, its staminate spathes have many flowers and the flowers have 1-3 stamens; the pistillate flowers have the ovary and fruit truly inferior. Consequently it must remain in the Hydrocharitaceae.

There is a publication by Moldenke (1940: 354) which credits St. John with the *Elodeaceae*. This publication was not authorized by the present writer, and at that time he did not classify *Egeria* or *Elodea* as in the Elodeaceae, but rather in the Hydrocharitaceae.

NATURAL KEY TO GENERA.

Staminate spathes 1-flowered, with a slender stalk-like base, or if sessile, subglobose and containing a sessile staminate flower that is liberated at anthesis, or if with an urceolate spathe the flowers perfect; staminate flowers with 9 stamens, the 3 central ones raised on a common stalk of connate filaments, or rarely the stamens 9 and equal; anthers with 2 locules explosively dehiscent at the axial side of the connective into one widespreading valve (septifragal) which then simulates a heavy ribbed petal; or the flowers perfect, with 3 stamens; filaments smooth, non-glandular, much shorter than the anthers in the staminate flowers; petals smaller than or but little larger than the sepals; nectary lacking; pistillate spathe evenly and shallowly bifid at apex; pistillate flowers with 3 (or 4) entire or bifid or bipartite stigmas; flowers water-pollinated after the explosion of the anthers.

Elodea.

Staminate spathes 2-4-flowered, sessile, funnellform or ellipsoid; stamens 9 (-10), distinct; filaments papillose glandular above, at least thrice as long as the anthers; anthers each with 2 locules dehiscent by longitudinal lateral sutures into 2 equal valves (loculicidal); petals about thrice larger than the sepals; in the center of the flower a dark nectary; pistillate spathe split halfway down one side; the 3 stigmas 2-3-parted; flowers insect-pollinated.

Egeria.

EGERIA Planch.

Ann. Sci. Nat., Bot. III, 11: 79-81. 1849. St. John in Darwiniana 12: 293-307. 1961.

Egeria densa Planch., Ann Sci. Nat. Bot. III, 11 (1849) 80. *Elodea densa* (Planch.) Caspary, Monatsber. Kgl. Preuss. Akad. Wissensch. 1857 (1857) 48; also in Pringsheim's Jahrb. Wissensch. Bot 1 (1858) 475 (and 99 in repr.); *Elodea canadensis* Rich. in Michx. var. *gigantea* Hort. in Bailey, L. H., Standard Cyclop. Hort. 2 (1914) 111; *Elodea*

gigantea Santos, Bot. Gaz. 75 (1923) 44, 50; *Elodea densa* (Planch.) Casp. var. *longifolia* Hort. in Parey's Blumengärtnerei, ed. by C. Bonstedt (1931) 110; *Anacharis densa* (Planch.) Victorin, Contrib. Lab. Bot., Univ. Montréal 18 (1931) 41; *Philotria densa* (Planch.) Small, Man. Southeastern Flora (1933) 28; see St. John, in Darwiniana 12 (1961) 297-298, 300-302, fig. 1, a-e, 2.

Description of all specimens examined: Submersed aquatic; stem stout, 2-3 mm. in diameter; lower leaves in whorls of 3, and 3-7 mm. long, 1.5-2 mm. wide, ovate or lance-ovate; middle and upper leaves in whorls of 4 or 5, and 12-40 mm. long, 1.7-5 mm. broad, oblong to broadly linear, acute, serrulate; nodes close together, but the leaves mostly divergent; flowers dioecious; staminate spathes borne in the upper axils, 11-12 (-14) mm. long, 3.5 mm. broad, elliptical, cleft down one side, the apex bifid with 2 short blunt teeth; staminate flowers 2-4 from each spathe, long stipitate, raised above the water by the slender, thread-like, elongating hypanthium which is 3-6 cm. long; sepals 3-4 mm. long, elliptic-oblong, boat-shaped, dark striate; petals 9.5-11 mm. long, 3.5-9 mm. wide, obovate to suborbicular, subacute at tip, cuneate at base, white, erect; stamens 9 (-10), distinct, 2-2.5 mm. long, the central ones not connate; filaments heavy, clavate, flattened, glandular papillose above; anthers 0.5-1.2 mm. long, unequal; nectary central, green, 3-lobed, secreting abundant nectar; pistillate plants unknown to the writer, not represented in any of the numerous herbaria examined, including that of L. Hauman-Merck in Brussels, but described in detail by him while in Buenos Aires, and the following description is drawn from a translation of his article in Rec. Inst. L. Errera 9 (1913 = 1912) 34-35; pistillate spathe 10-11 mm. long, entire or slightly cleft along the median line, 1-flowered; calyx like the above; corolla smaller, the petals 8 mm. long, 8 mm. wide, less regularly plaited; the 3 staminodia 2.5 mm. long, filiform, sharp, yellow, covered with papillae, alternating with the branches of the style; style white, trifid to the base, with filiform lobes 3 mm. long, deeply 2-3-cleft and covered with papillae for their whole length; at the base of each lobe towards the outside, a little green nectary; ovary surmounted by a thread-like stalk 2-6 cm. long, 1 mm. in diameter; ovary cavity small, 1-celled, producing a swelling at the base of the neck; ovules 3-6, erect; fruit 7-8 mm. long, 3 mm. in diameter, obscurely trigonous, attenuate at the summit and surmounted by a vestige of the neck of the ovary; pericarp membranous, transparent; seeds 7-8 mm. long, (rare), sessile, fusiform, completely filling the locule owing to their swollen, mucilaginous seed coat and papillae, surmounted by a slender 2 mm. filament.

Holotype: "in ditione Platensi, prope Bonariam; *Tweedie* in herb. Hook." (= Buenos Aires, Argentina), (κ)! Type examined!

Range: Southern Brasil, Paraguay, Uruguay, and northern Argentina.

Egeria densa is universally cultivated in biological labo-

ratories, and frequently grown in aquaria and water cultures. It has escaped from cultivation and has established itself in the waters of Massachusetts, New York, New Jersey, Pennsylvania, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Alabama, Louisiana, Texas, Nebraska, Arkansas, Missouri, Arizona, Oregon, and California. It is also established in Germany, France, Italy, Japan.

ELODEA L. C. Richard in Michaux

Perennial submerged aquatic herbs in fresh (or rarely brackish) water, rooting in the (usually muddy) bottom or free drifting when broken loose; roots unbranched, smooth, with a root cap; stems slender, simple or sparsely dichotomously branched; lowest leaves alternate, opposite, or in whorls of 3, and reduced; middle and upper leaves opposite or in whorls of 3-7, linear to oblong, acute or obtuse, sharply serrulate, 1-nerved; stipules minute, evanescent; flowers hypogynous, and in a few species perfect, with 3 alternate stamens and 3 stigmas; flowers of most species dioecious and raised to the surface by a slender hypanthium enclosing the style; sepals 3, elliptic, chartaceous; petals 3 (rarely 0), membranous, white to purple, elliptic to linear; staminate flowers with 9 stamens, usually 6 in a lower, outer ring, and the inner 3 raised on a fused filament column; anthers bilocular, explosively septifragal; pollen exine spiny; pistillate flowers with 3 alternate staminodia; common style running up through and slightly exceeding the hypanthium tube; style branches 3; stigmas 3, bifid (or entire), exceeding the perianth; ovary unilocular with 3 parietal placentae and/or a basal placenta; ovules several, orthotropous or anatropous; fruit capsular; seeds cylindric to fusiform, glabrous, papillose, hirsutulous, or mucilaginous.

The writer has been doing research on *Elodea* since 1919, has studied it in the field and in many of the major and minor herbaria of the world. He has seen the holotypes of all previously described species and minor taxa.

Like most other flowering plants, the species of *Elodea* have their most constant and best diagnostic characters in the structure of their flowers. These are tiny, so in our illustrations they are shown five times magnified.

For the benefit of curators of herbaria and for students of local floras, the distribution of each species is mapped, and all the collections that have been studied, are cited, but this is done as briefly as possible. Such a detailed presentation is valuable, as the identification of collections of *Elodea* has

proven so difficult that the individual botanist has usually felt uncertain of his determinations.

The natural ranges of the species of *Elodea* are of interest. In North America only *E. canadensis* spans the continent, from Quebec to British Columbia, south to Alabama, and California. This species is also the one which, when introduced to Ireland in 1836, soon ran rampant over Europe, and now is also established in Asia, Africa, and Australia. *Elodea Nuttallii* has the next largest range, being abundant in the lowlands from Maine to North Carolina, and occurring westward to Missouri, and also in Idaho (where it is probably introduced). The other North American species are more restricted in occurrence, and several are known only from single localities.

In South America, too, there is one widespread species, *Elodea granatensis* Humb. & Bonpl. It occurs from Colombia eastward to French Guiana, and southward to Argentina. The other species of that continent have much smaller ranges.

Between the northern border of Mexico and the southern border of Panama there are no known collections of indigenous *Elodea*. The genus does not occur naturally in any part of the West Indies or Central America. The North American species are all of temperate regions, but several of the South American ones are of the tropics, so the absence in Central America cannot be due solely to the climate, nor does it seem to be due to lack of collecting. The writer can offer no explanation of this broad gap between the areas occupied by the 9 North American and the 8 South American species.

Many botanists have assisted the writer during his prolonged investigation. They are too many to thank individually, but one of them must be singled out. Dr. J. E. Dandy, Keeper of Botany, Natural History Museum, London, has contributed much from his knowledge of aquatics and their nomenclature.

GENERAL MORPHOLOGY — The members of the genus *Elodea* are submerged aquatics, rooting in the bottom, or free floating (when broken loose). Their growth is erect until they reach the surface of the water.

The roots are slender, white or pale, and unbranched. They have a root cap, but no root hairs. Adventitious roots are freely produced from nodes of the stem, and most abundantly so on detached, drifting branches.

The stems are erect, rather weak and brittle, cylindric, simple or dichotomously branched.

The lowest leaves are alternate, opposite, or in whorls of three. The middle and upper leaves are opposite or in whorls of 3-7. They are from linear to oblong, acute or obtuse, and sharply serrulate. Their venation consists of a single midrib, and the thin, bright or pale green blades are translucent.

Axillary scales or stipules, entire or fimbriate, are present and visible on fresh specimens. They are minute and evanescent, and on dried specimens are invisible.

The flowers are solitary, axillary, and in bud are enclosed in a membranous, globose or urceolate spathe which opens at the bifid apex. Hypanthium (present in most species) filiform, elongating and raising the bud to the surface where it expands. Flowers perfect and with only 3 stamens in a few species, or as in most species, dioecious. Sepals 3, elliptic, concave, firm, chartaceous, in part greenish and in many streaked with black or purple. Petals 3, membranous, white or bluish or the outer part purple, elliptic to spatulate or linear. Staminate flowers with 9 erect stamens, of which 6 are in an outer, lower ring, and the inner 3 are mostly elevated on a smooth, fused filament column, or rarely all of equal length and attachment. Anthers with 2 locules, these septifragal, explosively dehiscent at the axial side of the connective, becoming flat and resembling heavy ribbed petals. Pistillate flowers with similar hypanthium, sepals and petals. Staminodia 3 and diverse in the different species, being a mere subulate filament or a filament with more or less abortive, sterile anther remnants. Ovary 1-celled; ovules several, borne on parietal or basal placentae. Style filiform, exceeding the hypanthium which surrounds it, the apex 3-lobed. Stigmas 3, ligulate or spatulate, deeply bifid (or entire), reddish papillose on the upper receptive surface. Fruit capsular; seeds cylindric to fusiform, glabrous, papillose, hirsutulous, or mucilaginous.

POLLEN GRAINS — The pollen grains are nonaperturate, 94-125 μ long, and the surface bears thin, sharp spinules, separate or on a connecting reticulum. The grains become separate or remain attached in tetrads. Apparently only the following species have had their pollen described: *E. callitrichoides*, *E. canadensis*, *E. Ernstae*, and *E. Matthewsii* (Erdtman 1943: 62, pl. 2, fig. 22; 1952: 207-208).

CHROMOSOMES — The 2X number of chromosomes is 16 in *Elodea callitrichoides*, and 24 in *E. canadensis*. The related genus *Egeria* has in its species *E. densa* 48 chromosomes (Darlington & Janaki Ammal, 1945: 276). The record of the number 48 for *Elodea canadensis* is evidently due to examination of a misidentified specimen of *Egeria densa*.

POLLINATION — Nearly all of the species of *Elodea* are dioecious. Their flowers grow upward, raised by the elongating hypanthium, till they reach the surface of the water. There the flowers expand, the three sepals spread outward and reflex slightly, and their waxy outer surfaces repel water and serve as floats to uphold the flower.

In the pistillate flowers the longest, heaviest parts are the three bifid stigmas which project beyond the perianth parts, overweight it, causing it to partly flop over on one side. Thus the two nearest stigmas arch over and their tips rest on the water surface. Due to their weight and unwettable nature, they push down and cause a depression of the surface film of the water.

The staminate flowers, in all the dioecious species but one (*E. Nuttallii*), in growth are raised to the water surface by an elongating, thread-like hypanthium, just as are the pistillate ones. The anther dehiscence is by an explosion which scatters the pollen grains on the nearby water surface. The outer coat of the pollen grains is covered with spines which entrap air, hold back the water, and give buoyancy to the grains. They float and bob along on the surface of the water. When and if they drift to a pistillate flower, the grains slide down into the depression of the water surface around a stigma, contact its sticky papillose

surface, and are in position to accomplish pollination and fertilization.

This ingenious method of pollination is effective, and it does work. Fertilization does occur and seeds are formed, but rarely. It is quite clear that the two sexes of the species are not equal in number. In the more local and rarer species, mere chance has determined whether the staminate or the pistillate was collected and hence is the only sex known. Among the other species of wide distribution, in which both sexes are known, there is still an evident disparity. In collections the pistillate plants are many times more abundant than the staminate. It appears that seed formation is rare.

DISPERSAL — Ripe seeds, freed in the water of the lake or stream, may be carried some distance by moving water and allow the establishment of a new colony. From the rarity of seed production, this natural dissemination seems to be a minor method of dispersal of a species.

The branches of *Elodea* plants are slender and rather brittle. They bend and sway with water currents, but are easily broken. Detached branches, still submerged, drift away. Unless stranded and dessicated they retain life and continue growth. Adventitious roots are produced at the nodes, and by them the loose branch may again be rooted in the bottom of the body of water. It seems very clear that this vegetative propagation by fragmentation is the principal method of dispersal of the species.

Species of *Elodea* may also be dispersed by water birds. Stems removed from the water and exposed to the air for 23 hours, and then replaced in water have recovered in one day. Rootstocks of *E. canadensis* have been found in the nests of the common tern on islands on the coast of Sweden (Ridley, 1930: 537-538). Such deliberate or accidental transport by birds is apparently the principal means of spread of the plant from one water system to another. That these methods are effective, has been evidenced by the phenomenal spread of the pistillate plant of *E. canadensis* throughout Europe.

DISTRIBUTION — The genus *Elodea* contains at present 17

species, 9 of which occur in North America, and 8 in South America.

In North America the indigenous species occur across southern Canada from Quebec to British Columbia, and southward in the United States to Alabama, Mississippi, New Mexico, Arizona, and California. The published records of occurrence in Texas are unsubstantiated.

In South America native species are known from Colombia southward to Peru, at both low and high altitudes. They also occur from Colombia eastward to French Guiana, and south to Argentina.

In the West Indies there are no records of *Elodea*.

In Central America, the only records are in Mexico, of *Elodea canadensis* and *Egeria densa*, recently established at a few localities near Mexico City. They are doubtless adventives, escaped from culture in gold fish bowls or tanks. Good habitats are numerous both in the temperate and in the tropical sections of the region. Having been created in one of the Americas, the genus must have spread to the other one across Central America. Its absence in Central America now seems to be a fact and not a mere apparent absence due to lack of collecting. Panama, Costa Rica, Guatemala, and Mexico have been explored too long and too thoroughly for that hypothesis to receive any credence by the writer.

PHYLOGENY — Most of the species of *Elodea* are dioecious or functionally dioecious. However, in their pistillate flowers they all have staminodia, three in number, alternate with the petals. These staminodia are abortive in various degrees. The extreme in reduction is to a slender, subulate structure, representing solely a filament. Other species have an expanded apex, bidentate or retuse, representing an abortive remnant of an anther. These diverse sorts of staminodia evidence an evolutionary trend towards loss of stamens in the flowers. It would not be reasonable to postulate evolution in the other direction, — that these staminodia were stages in the development of perfect stamens. Hence, it seems clear that in this genus the more primitive type of flower is the bisexual or perfect one. These more primitive

species are the South American *E. granatensis* and the North American *E. Brandegeae*, and *E. Schweinitzii*. The second and third of these are rare and very local, but the first is common and with a very broad range. Among these three the writer cannot single out one as the most primitive species.

NATURAL KEY TO THE SUBGENERA, SECTIONS AND SPECIES OF ELODEA

Flowers perfect. subgenus *Apalanthe*.

Stigmas entire, included, equaling the filaments; median and upper leaves in whorls of 3. 2. *E. Brandegeae*.

Stigmas exserted,

Stigmas 3, bifid, equaling the anthers; middle and upper leaves in whorls of 7 (or 5). 8 (part 1), 13 (part 3). *E. granatensis*.

Stigmas 4 (or 3), usually entire; middle and upper leaves in whorls of 3. 17. *E. Schweinitzii*.

Flowers dioecious. subgenus *Elodea*.

Staminate flowers sessile, at anthesis liberated, floating to and expanding on the surface of the water. section *Natator*, with a single species. 7 (part 1), 18 (part 4). *E. Nuttallii*.

Staminate flowers protruded from the spathe by the elongating, filiform base of the hypanthium, not liberated. section *Elodea*.

Section ELODEA

Dioecious species with both sexes known.

Stigmas entire.

Staminodia 1.5 mm. long, obtuse; pistillate spathe 3-7 cm. long, the apical teeth divergent; staminate petals 0.6 mm. broad, linear. 5 (part 1), 21 (part 4). *E. longivaginata*.

Staminodia 0.3 mm. long, bifid; pistillate spathe 1.8 cm. long, the apical teeth erect; staminate petals 1.5 mm. wide, oblanceolate; pistillate sepals oblong-elliptic. 12. *E. titicacana*,

Stigmas bifid.

Stigmas bifid for half or more than half of their length.

Anthers 4 mm. long; middle and upper leaves in whorls of 3-4. 11. *E. Potamogeton*.

Anthers 3.5 mm. or less in length.

Middle and upper leaves opposite or occasionally some of them in whorls of 3. 14. *E. callitrichoides*.

Middle and upper leaves in whorls of 3-4.

Pistillate petals wanting; staminate petals 0.4-0.6 mm. wide, linear, acute; middle and upper leaves in whorls of 3-4. 16. *E. Richardii*.

Pistillate petals present; staminate petals 1.1-2 mm. wide, somewhat dilated, obtuse; middle and upper leaves in whorls of 3.

Pistillate sepals oblong-deltoid; stigmas 5-5.5 mm. long; staminate petals 1.1 mm. wide, slightly dilated.

15. *E. Ernstae*.

Pistillate sepals oblong to elliptic; stigmas 3.5-3.8 mm. long; staminate petals spatulate.

Pistillate sepals 3 mm. long; staminate sepals ovate; staminate petals 1.5 mm. wide. 10. *E. peruviansis*.

Pistillate sepals 2.4-2.6 mm. long; staminate sepals elliptic; staminate petals 1.8-2 mm. wide.

9. *E. Matthewsii*.

Stigmas bifid for a third or less than a third of their length.

Pistillate sepals 2-2.2 mm. long; staminate petals slightly dilated near the apex; middle and upper leaves in whorls of 3. 3 (part 1), 19 (part 4). *E. canadensis*.

Pistillate sepals 1.4 mm. long; staminate petals linear; middle and upper leaves opposite or occasionally in whorls of 3 at a few of the upper nodes. 1. *E. bifoliata*.

Dioecious species of which only one sex is known.

Leaves 0.5-1.5 mm. broad, the median and upper ones in whorls of 3.

Leaves less than 1 mm. broad; pistillate flowers unknown; staminate petals 0.5 mm. wide; stamens equal, all attached to summit of hypanthium. 20. *E. linearis*.

Leaves 0.5-2 mm. broad; pistillate flowers known; petals 1.1 mm. wide.

Staminodia obdeltoid, petaloid throughout; middle and upper leaves 0.5-1.5 mm. wide, flaccid. 4. *E. columbiana*.

Staminodia subulate at base, the tip petaloid, elliptic; middle and upper leaves 1-2 mm. wide, thin but not flaccid.

6. *E. nevadensis*.

LIST OF ELODEA SPECIES.

Monograph, part 1. Res. Stud. Wash. State Univ. 30: 19-44. 1962.

1. *E. bifoliata* St. John
2. *E. Brandegeae* St. John
3. *E. canadensis* Rich. in Michx.
4. *E. columbiana* St. John
5. *E. longivaginata* St. John
6. *E. nevadensis* St. John
7. *E. Nuttallii* (Planch.) St. John

Monograph, part 2. *Caldasia* 9: 95-113, 1964.

8. *E. granatensis* Humb. & Bonpl.
9. *E. Matthewsii* (Planch.) St. John
10. *E. peruviansis*, St. John
11. *E. Potamogeton* (Bert.) Espinosa
12. *E. titicacana*, St. John

Monograph, part 3. *Darwiniana* 12: 639-652. 1963.

13. (8.) *E. granatensis* Humb. & Bonpl.
14. *E. callitrichoides* (Rich.) Casp.
15. *E. Ernstae* St. John
16. *E. Richardii* St. John

Monograph, part 4.

17. *E. Schweinitzii* (Planch.) Casp.
18. (7.) *E. Nuttallii* (Planch.) St. John
19. (3.) *E. canadensis* Rich. in Michx.
20. *E. linearis* (Rydb.) St. John
21. (5.) *E. longivaginata* St. John

NAMES AND SYNONYMS IN ELODEA.

Synonyms are in italic and accepted names in roman type. The names published in *Elodea* Juss. (an orthographic variant of *Elodes* Adans.), and like it in the Hypericaceae, are omitted here.

Anacharis

- A. Alsinastrum* Babington, Ann. & Mag. Nat. Hist. II, 1: 83-84, 86, 1848; Ann. Sci. Nat. Bot. III, 11: 74, 1849 = *Elodea canadensis*.
- A. callitrichoides* Rich., Mém. Inst. de France 12(2): 7-8, 75, pl. 2 bottom, 1811 = 1814 = *Elodea callitrichoides*.
- A. canadensis* Planch., Ann. & Mag. Nat. Hist. II, 1: 86, 1848; Ann. Sci. Nat. Bot. II, 11: 75, 1849, independent species, not based on *Elodea canadensis* Rich. in Michx., but = *Elodea canadensis*.
var. *latifolia* (Casp.) Sanio, Verhandl. Bot. Verein Prov. Brandenburg 32: 121, 1890 = *Elodea canadensis*.
var. *latifolia* (Casp.) Sanio, var. *repens* Sanio, Verhandl. Bot. Verein Brandenburg 32: 121, 1890, invalid, a variety under a variety.
var. *Planchonii* (Casp.) Victorin, Contrib. Lab. Bot., Univ. Montréal 18: 40, 1931 = *Elodea canadensis*.
- A. chilensis* Planch., Ann. & Mag. Nat. Hist. II, 1: RF, 1848, Ann. Sci. Nat. Bot. III, 11: 75, 1849 = *Elodea Potamogeton*.
- A. densa* (Planch.) Victorin, Contrib. Lab. Bot., Univ. Montréal 18: 41, 1931 = *Egeria densa*.
- A. Hilariana* Casp., Monatsber. Kgl. Preuss. Akad. Wissensch. 1857: 49, 1857 (in repr. p. 13); Pringsheim's Jahrb. 1: 476, 1858, published in the synonymy of *Elodea Naias* = *Egeria Naias*.
- A. linearis* (Rydb.) Victorin, Contrib. Lab. Bot., Univ. Montréal 18: 41, 1931 = *Elodea linearis*.
- A. Matthewsii* Planch., Ann. & Mag. Nat. Hist. II, 1: 86, 1848 = *Elodea Matthewsii*.
- A. Naias* (Planch.) Victorin, Contrib. Lab. Bot., Univ. Montréal 18: 42, 1931. The authorities were published as "(Casp.) Victorin." = *Egeria Naias*.
- A. Nuttallii* Planch., Ann. & Mag. Nat. Hist. II, 1: 86, 1848; Ann. Sci. Nat. Bot. III, 11: 74, 1849 = *Elodea Nuttallii*.

- A. occidentalis* Victorin, Contrib. Lab. Bot., Univ. Montréal 18: 40, 1931, based on *Serpicula occidentalis* Pursh, a superfluous name which cannot be transferred = *Elodea Nuttallii*.
- A. Planchonii* (Casp.) Rydb., Fl. Prairies & Plains Cent. N. Am. 57, 1932 = *Elodea canadensis*.
- A. Planchonii* (Casp.) M. E. Peck, Man. Higher Pl. Ore. 76, 1941 = *Elodea canadensis*.
- A. pomeranica* (Reichenb.) Peterm., Deutschl. Fl. 530, t. 82, fig. 650 a, b, 1849. The description and the leafy shoot, fig. 650 = *Hydrilla verticillata* (L. f.) Royle. The staminate and pistillate flowers shown in fig. 650 = *Elodea canadensis*.
- A. Potamogeton* (Bert.) Victorin, Contrib. Lab. Bot., Univ. Montréal 18: 41, 1931 = *Elodea Potamogeton*.
- A. Tripteris* (L.) Steud., Nom. Bot., ed. 2, 1: 82, 360, 1840. This was an obvious error, not a combination intended by the author, as is confirmed under *Chrysosystema* on page 360. = *Coreopteris Tripteris* L.

Apalanthé

- Ap. granatensis* (Humb. & Bonpl.) Planch., Ann. & Mag. Nat. Hist. II, 1: 87, 1848; Ann. Sci. Nat. Bot. III, 11: 76, 1849 = *Elodea granatensis*.
- Ap. guyannensis* (Rich.) Planch., Ann. & Mag. Nat. Hist. II, 1: 87, 1848; Ann. Sci. Nat. Bot. III, 11: 76, 1849 = *Elodea granatensis*.
- Ap. Schweinitzii* Planch., Ann. & Mag. Nat. Hist. II, 1: 87, 1848; Ann. Sci. Nat. Bot. III, 11: 76, 1849 = *Elodea Schweinitzii*.

Babingtonia

- B. pestifera* Syme in Sowerby, English Bot. ed. 3, 9: 83, 1869, published in synonymy = *Elodea canadensis*.

Diplandra

- D. Potamogeton* Bert., Mercurio Chileno 13: 612, 1829 = *Elodea Potamogeton*.

Elodea

- E. bifoliata* St. John, Res. Stud., Washington State Univ. 30: 23-24, figs. 3, b, c, 4, a, b, 5, 1962.
- E. Brandegeae* St. John, Res. Stud., Wash. State Univ. 30: 25-26, figs. 2, c, d, 4, m, n, 5, 1962.
- E. callitrichoides* (Rich.) Casp., Monatsber. Kgl. Preuss. Akad. Wissensch. 1857: 47-48, 1857 (in reprint pp. 11-12). The combination was made by Caspary, but with a question mark. Yet, it was a valid publication.
- var. *ernstae* Erdtman, Pollen Morphology and Plant Taxonomy, Angiosperms 207-208, 1952. The variety lacks a diagnosis, and is invalid = *Elodea Ernstae*.
- E. canadensis* Rich. in Michx., Fl. Bor.-Am. 1: 20, 1803.
- var. β *angustifolia* Aschers. & Graebn., Syn. Mitteleur. Fl. 1: 403, 1897, *nomen nudum*.

- var. *angustifolia* (Britton ex Rydb.) Farw., Am. Midl. Nat. 10:203, 1927 = *E. Nuttallii*.
- var. *gigantea* Hort., Bailey, Stand. Cyclop. Hort. 2: 1,111, 1914 = *Egeria densa*.
- var. *latifolia* (Casp.) Sanio var. *repens* Sanio, Verhandl. Bot. Vereins Prov. Brandenb. 32: 121, 1891 = 1890, a variety under a variety, and hence invalid.
- var. *latifolia* Aschers. & Graebn., and forma *latifolia* Aschers. & Graebn., Synops. Mitteleur. Fl. 1: 403, 1897 = *E. canadensis*.
- var. *Planchonii* (Casp.) Farw., Am. Midl. Nat. 10: 203, 1927 = *E. canadensis*.
- E. capensis* M. Ernst, Ber. Schweiz. Bot. Ges. 55: 35, 1945, published in synonymy.
- E. chilensis* (Planch.) Casp., Monatsber. Kgl. Preuss. Akad. Wissensch. 1857: 47, 1857 (in repr. p. 11) = *E. Potamogeton*.
- E. chinensis* Casp. ex. Ind. Kew. Suppl. 1: 152, 1901-1906, misprint for *E. chilensis*.
- E. columbiana* St. John, Res. Stud., Wash. State Univ. 30: 37-38, figs. 3, d, 4, g, h, 5, 1962.
- E. crispa* Hort. ex Henkel, Haupt-Katalog 26, 1908 = *Lagarosiphon major* (Ridl.) Moss.
- E. densa* (Planch.) Casp., Monatsber. Kgl. Preuss. Akad. Wissensch. 1857: 49, 1857 (in repr. p. 13). The combination was made with a question mark, but was a valid one = *Egeria densa*.
- var. *crispa* Hort. ex Wehrh., Gartenstauden 1: 10, 1929, published in synonymy = *Hydrilla verticillata* Royle var. *crispa* Casp.
- var. *longifolia* Hort. ex Bonstedt in Parey's Blumengaertnerei 1: 110, 1930, = *Egeria densa*.
- E. Ernstae* St. John, Darwiniana 12: 644, 646, 648, figs. 1, a, b, d, e, 3, 1963.
- E. gigantea* Santos, Bot. Gaz. 75: 44, 50, 1923 = *Egeria densa*.
- E. granatensis* Humb. & Bonpl., Pl. Aequin. 2: 150, pl. 128, 1813.
- E. guyannensis* Rich., Mém. Inst. France 12(2): 4, 75, pl. 1, 1811 = 1814 = *E. granatensis*.
- var. *dicranoides* Casp., Monatsber. Kgl. Preuss. Akad. Wissensch. 1857: 48, 1857 (in repr. p. 12), and in Pringsheim's Jahrb. 1: 502, 1858 = *E. granatensis*.
- f. *longifolia* Chodat & Hassler, Bull. Herb. Boiss. II, 3: 1,033, 1903 = *Egeria Naias*.
- E. ioensis* Wylie, Nat. Hist. Bul., State Univ. Iowa 6(4): 48-50, pl. 1-2 1913 = *E. canadensis*.
- E. iowensis* Wylie (as *Iowensis*), Proc. Iowa Acad. Sci. 17: 82, 1910, nomen provisorium, = *E. canadensis*.
- E. Kochii* Herter, Revista Sudamer. Bot. 6: 134, fig. 2, 1940 = *E. Naias*.

- E. latifolia* Casp., Monatsber. Kgl. Preuss. Akad. Wissensch. 1857: 46, 1857 (in repr. p. 11), published as a doubtful species, based upon sterile material = *E. canadensis*.
- E. linearis* (Rydb.) St. John, made above in this paper.
- E. longivaginata* St. John, Res. Studies, Wash. State Univ. 30: 38-40, figs. 2, e-j, 4, c, d, 5, 1962.
- E. Matthewsii* (Planch.) St. John ex Erdtman (as Planch.), Introd. Pollen Analysis 62, pl. II, fig. 22, 1943. It has the measurements of a pollen grain, and an outline drawing of one grain. It lacks the reference to the basionym, and the publication was not authorized by St. John. Erdtman apparently saw the binomial written upon an herbarium sheet.
- E. Matthewsii* (Planch.) St. John, Darwiniana 12: 307, 1961; Caldasia 9: 101, 103, figs. 4, a, b, 5, a, b, 8, 1964.
- E. minor* (Small) Farwell, Rept. Mich. Acad. Sci. 17: 181, 1916 = *E. Nuttallii*.
- E. Naias* (Planch.) Casp., Monatsber. Kgl. Preuss. Akad. Wissensch. 1857: 49, 1857 (in repr. p. 13-14); and altered to *E. Najas* in Pringsheim's Jahrb. 1: 476-477, 503, 1858. = *Egeria Naias*.
- E. nevadensis* St. John, Res. Stud., Wash. State Univ. 30: 41-43, figs. 3, a, 4, i, j, 5, 1962.
- E. Nuttallii* (Planch.) St. John, Rhodora 22: 29, 1920, sensu basionym, *Anacharis Nuttallii* Planch., non sensu St. John (1920).
- E. oblongifolia* Michx. ex Casp., Pringsheim's Jahrb. 1: 462, 1858, published in synonymy = *E. canadensis*.
- E. occidentalis* St. John, Rhodora 22: 27-29, 1920. This was ostensibly a combination based upon *Serpicula occidentalis* Pursh, excluding his synonym *E. canadensis* Michx. The epithet *canadensis* was available, and Pursh should have adopted it, so his new epithet *occidentalis* is illegitimate and cannot be transferred. St. John also cited in synonymy *Philotria minor* Small. The epithet *minor* was available and should have been adopted, so St. John's epithet is also illegitimate = *Elodea Nuttallii*.
- E. orinocensis* Rich. (as *Orinocensis*), Mém. Inst. de France 12(2): 75, 1811 = 1814, = *E. granatensis*.
- E. paraguayensis* Herter, Revista Sudamer. Bot. 6: 134, fig. 3, 1940 = *Egeria Naias*.
- E. peruviansis* St. John, Caldasia 9: 103, 105, 107, figs. 3, a, b, 5, g, h, 6, 8, 1964.
- E. Planchonii* Casp., Monatsber. Kgl. Preuss. Akad. Wissensch. 1857: 47, 1857; and Pringsheim's Jahrb. 1: 468-469, 500-501, 1858 = *E. canadensis*. This was based upon *Anacharis canadensis* Planch. and doubtfully on *A. canadensis* Chatin.
- E. Potamogeton* (Bert.) Espinosa, Rev. Chil. Hist. Nat. 31: 150-155, fig. 10, 10(2), 1928.
- E. Richardii* St. John, Darwiniana 12: 649, 651, figs. 1, f, g, 2, a, b, 3, 1963.

E. Schweinitzii (Planch.) Casp., Monatsber. Kgl. Preuss. Akad. Wissensch. 1857: 46, 1857 (in repr. p. 10-11); Pringsheim's Jahrb. 1: 468, 500, 1858, published with a question mark as a doubtful species, yet it is valid.

E. titicacana St. John, Caldasia 9: 111-112, figs. 3, d, e, 5, c, d, 8, 1964.

E. verticillata (L. f.) F. Muell., Key Syst. Vict. Pl. 1: 423, 1888 = *Hydrilla verticillata* (L. f.) Royle.

Hapalanthe

H. Schweinitzii Planch. ex Peterm., Deutschl. Fl. 530, t. 82, fig. 650 e, 1849. The generic name is merely an orthographic variant of *Apalanthe*, and the species = *Elodea Schweinitzii*.

Luchia

L. Berteroniana Steud., Nom. Bot. ed. 2, 2: 75, 1841, *nomen nudum* = *Elodea Potamogeton*.

Philotria

P. angustifolia Britton ex Rydb., Fl. Colo. 15, 1906 = *Elodea Nuttallii*. Rydberg in Bull. Torrey Bot. Club. 35: 460, 1908 stated that he applied the name to a different species, that is to *Philotria Planchonii* (Casp.) Rydb. = *Elodea canadensis*.

P. densa (Planch.) Small, Man. S. E. Fl. 28, 1,503, 1933 = *Egeria densa*.

P. Canadensis (Rich. in Michx.) Britton, Science II, 2: 5, 1895 = *Elodea canadensis*.

P. granatensis (Humb. & Bonpl.) Victorin, Contrib. Lab. Bot., Univ. Montréal 18: 42, 1931 = *Elodea granatensis*.

P. guyannensis (Rich.) Victorin (as *guyanensis*), Contrib. Lab. Bot., Univ. Montréal 18: 42, 1931 = *Elodea granatensis*.

P. Iowensis Wylie, Proc. Iowa Acad. Sci. 17: 82, 1910, published as a synonym of *Elodea Iowensis*, a provisional name = *Elodea canadensis*.

P. Iowensis Wylie, Science, n. s. 33: 263, 1911 = *Elodea canadensis*.

P. linearis Rydb., Bull. Torrey Bot. Club 35: 464, 1908 = *Elodea linearis*.

P. minor Small, Fl. S. E. U. S. 47, 1903, published as (Engelm.) Small, but Engelmann's *Udora verticillata* var. *minor* was not validly published = *Elodea Nuttallii*.

P. Nuttallii (Planch.) Rydb., Bull. Torrey Bot. Club 35: 461-462, 465, 1908, a provisional name, and hence invalid = *Elodea Nuttallii*.

P. Nuttallii (Planch.) Rydb. ex Britton & Brown, ILL. Fl. N. E. U. S., ed. 2, 1: 105, 1913 = *Elodea Nuttallii*.

P. occidentalis House, Bul. N. Y. State Mus. 243-244: 55, 1923, based upon *Serpicula occidentalis* Pursh, a superfluous name which cannot be transferred = *Elodea Nuttallii*.

P. orinocensis (Rich.) Victorin, Contrib. Lab. Bot., Univ. Montréal 18: 42, 1931 = *Elodea granatensis*.

P. Planchonii (Casp.) Rydb., Bull. Torrey Bot. Club 35: 462-463, 1908 = *Elodea canadensis*.

Serpicula

- S. canadensis* (Rich. in Michx.) Eaton, Man. ed. 5, 390, 1829. In large part and as to basionym = *Elodea canadensis*.
S. occidentalis Pursh, Fl. Am. Sept. 1: 33, 1814. A superfluous name substituted for the available *Elodea canadensis* Rich. in Michx. In part, *Elodea Nuttallii*, and illegitimately adopted for that by St. John (1920).
S. verticillata L. f. var. β *angustifolia* Muhl., Cat. Pl. Am. Sept. 84, 1813, *nomen nudum* = *Elodea Nuttallii*.

Udora

- U. brasiliensis* Mart., Fl. Brasil. 3(1): 99-100, 1847, a superfluous name, as he included as a synonym the valid and available *Elodea granatensis* Humb. & Bonpl.
U. canadensis (Rich. in Michx.) Nutt., Gen. N. Am. Pl. 2: 242, 1818, a superfluous name, since his monotypic new genus and species included the earlier and available *Elodea canadensis* Rich. in Michx.
U. granatensis (Humb. & Bonpl.) Spreng., in Linnaeus' Syst. Veg., ed. 16, 4(2): 25, 1827 = *Elodea granatensis*.
U. guyannensis (Rich.) Steud., Nom. Bot., ed. 2, 2: 727, 1841, (as *guyanensis*) = *Elodea granatensis*.
U. lithuanica Andrzej. ex Bess., Flora, Beibl. 1832(2): 13, 1832 (erroneously as *Hydora lithuanica*) = *Hydrilla verticillata* (L. f.) Royle.
U. occidentalis Koch, Syn. Fl. Germ. & Helvet. 669, 1837, based upon *Serpicula occidentalis* Pursh, and therefore, as to type = *Elodea canadensis*.
U. orinocensis (Rich.) Spreng., Syst. Veg. of Linnaeus, ed. 16 by Spreng., 4(2): 25, 1827 = *Elodea granatensis*.
U. pomeranica Reichenb., Ic. Fl. Germ. Helvet. 7: 31, 1845 = *Hydrilla verticillata* (L. f.) Royle
U. surinamensis Miq. ex Schomburgh, Reisen Brit.-Guiana 3: 900, 1848, a dubious species, with inadequate diagnosis. He said only that it was a perennial herb that bloomed all year.
U. verticillata Spreng. in Linnaeus' Syst. Veg., ed. 16 by Spreng., 1: 170-171, 1825. As to basionym = *Hydrilla verticillata* (L. f.) Royle, but, in part, is *Elodea canadensis*.
minor Engelm. ex Caspary Monatsber. Kgl. Preuss. Akad. Wissensch. 1857: 46, 1857 (in repr. p. 10); Pringsheim's Jahrb. 1: 465, 500, 1858, published in synonymy = *Elodea Nuttallii*.

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- Abrams, L. R. 9719 (3), (19).
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Addenda

Vol. 67, p. 7. At the end of the first paragraph add: capsules 4-6 mm. long, 1.3-1.8 mm. in diameter, lance-ellipsoid, 1-loculed, somewhat involute on the 2 flattened sides; seeds 3.5-5 mm. long, 0.5 mm. in diameter, cylindric, brown, white puberulous.

Corrigenda

Vol. 67, p. 1, line 3 from below, after 1-8, change the comma to a semicolon, and delete: is in press in Mutisia;

Page. 32, in the legend, for *longivaginat*, read: *longivaginata*

FLOWERING PLANTS NEW TO OR RARE IN KENTUCKY¹

ELIZABETH M. BROWNE AND E. T. BROWNE, JR.²

In an effort to catalog more completely the species of vascular plants in Kentucky and to plot their distribution, extensive field work has been done in the last three years. As a result, several species have been found in the state which were previously unknown to occur here or were first reported many years ago without having been reported since. Among these are the following:

SPOROBOLUS CRYPTANDRUS (Torr.) Gray. This species was reported for the only time previously by Price (1893). Fulton Co. Kentucky Point. *EMB & ETB 6051*; *EMB & ETB 6469*; *EMB & ETB 7624.5*.

¹Contribution No. 3 of the Kentucky Flora Project, University of Kentucky.

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